Researchn Istitute for Fundamental Physics
Kyoto University

新粒子　一般討論　　　Nov. 30, 1955　(1)

	Pais (I)	Pais (II)			F. F.	G. N.		~~Salam~~
			I^+	I^-		S.	τ.	η
N	$^2S_{1/2}$	$^2S_{1/2}$	1/2	0		1/2 (+)	1/2	0
Λ^0	$^2P_{3/2}$	$^2P_{1/2}$	0	1/2	13/2	1/2 (-)	0	−1
Σ		$^2P_{3/2}$	1	1/2	~~3/2~~	1/2	1	−1
Ξ			1/2	1		1/2	1/2	−2
π	$^3S_1$		1	0		0	1	0
θ	$^3P_1$		1/2	1/2			1/2	1
τ						(0^-)	1/2	1

Pais II.

Baryon　$|I^+ - I^-| = 1/2$

$$Q = I_3^+ + I_3^- + \frac{1}{2}$$

Meson

$$Q = I_3^+ + I_3^-$$

Salam

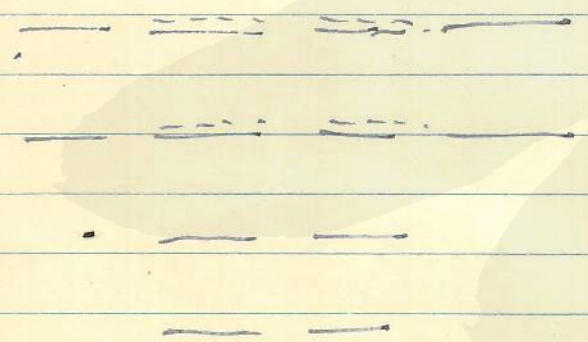
$$I_{\alpha\beta} = -I_{\beta\alpha}$$

$$\tau_i = \frac{1}{2}(I_{4i} + I_{jk})$$

$$\mu_i = \frac{1}{2}(I_{4i} - I_{jk})$$

$$Q = I_{43} = \tau_3 + \mu_3$$

(1/2, 1) > Ξ
(1/2, 0)
(1, 1/2) Σ
(0, 1/2)
(0, 1/2) Λ
(1/2, 0) N



Allowed

$\pi + N \to \tau^+ + \Xi$

$\pi + N \to \theta^+ + \Lambda^0$

$\to \theta^+ + \Sigma$

$\pi + N \to \tau^+ + \tau^- + N$

$\pi + N \to \theta^+ + \theta^- + N$

	τ_3	μ_3
$N^+ N^0$	$\frac{1}{2}, -\frac{1}{2}$	$\frac{1}{2}$
$\Xi^0 \Xi^-$	$\frac{1}{2}, -\frac{1}{2}$	$-\frac{1}{2}$
$\Sigma^+ \Sigma^0 \Sigma^-$	1, 0, −1	0
Λ^0	0	0
$\pi^+ \pi^0 \pi^-$	1 0 −1	0
$\tau^+ \tau^0 \tau^-$	0	1 0 −1
$\theta^+ \theta^0$	1/2 −1/2	1/2
$\overline{\theta^0}\ \theta^-$	1/2 −1/2	−1/2

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後藤, Espania

$R_3 \times R_2$

ω η

下平 Yang-Mills

locality

$\psi' \to e^{iT\theta(x)}\psi$ $\psi' \to S\psi$

gage Transf.

$\psi' \to e^{i\alpha(x)}\psi$

$(\gamma_\mu \partial_\mu + \kappa)\psi \to (\gamma(\partial_\mu + eA_\mu) + \kappa)\psi$

$A'_\mu \to A_\mu + \frac{\partial \alpha}{\partial x_\mu}$

B_μ - field (4×3 - component)

$[\gamma_\mu(\partial_\mu - i\varepsilon B_\mu) + \kappa]\psi = 0$

$B'_\mu = S^{-1}B_\mu S + S^{-1}\frac{\partial S}{\partial x_\mu}$

$(B^{scalar\,\prime}_\mu = B^{scalar}_\mu)$

$B_\mu = b_\mu(x) \cdot T$

$\mathcal{L} = -\frac{1}{4} f_{\mu\nu} f_{\mu\nu} - \bar{\psi}\gamma_\mu(\partial_\mu - i\varepsilon T b_\mu)\psi$
$- m\bar{\psi}\psi$

$f_{\mu\nu} = \frac{\partial b_\mu}{\partial x_\nu} - \frac{\partial b_\nu}{\partial x_\mu} + i\varepsilon(b_\mu \times b_\nu)$

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$$f_{\mu\nu}' = S^{-1} f_{\mu\nu} S$$

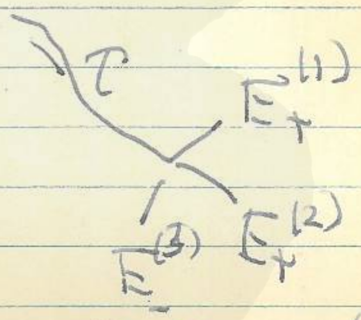
$b \to \pi + \gamma$, 10^{-20} sec.

Mass zero.

藤本氏

MIT　τ 66個　1^+

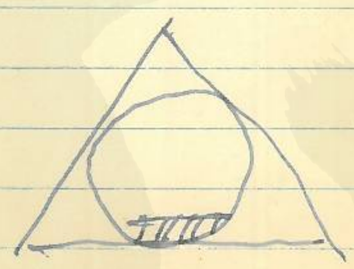
Cosmic Rays　100個　0^-



	π 最高	中間	最小	確率比
0^-	0.333	0.333	0.33	+L
1^+	0.52	0.33	0.15	+L
1^-	0.21	0.58	0.21	Pり
C.R.	32	31	28	/91
MIT	27	14	8	/49
sum	59	45	36	

0^-　1%
1^+　×

非常に低いπの数分。
0–4 MeV
C.R.　2/91
MIT　2/49
exp. v.　$\sim 1/20\ (0^-)$
　　　$\sim 1/20 \sim 1/100\ (1^+)$



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θ, τ の mass
1° Hρ & range　　Berkeley
2° Q-value　　C. R. Emulsion } Paris

$\theta^+(\chi^+) \to 2\pi^+$
τ^+) ± 10 me

(??) $K_\mu^+ \to \mu + \nu$
τ^+) ± 20 me

−20 ± 10 me
0 ± 10 me) inconsist.
(4 ± 4 me)

1. K . . . .
identical かどうか
{ theor. def.
exp.
2. neutral
θ_1, θ_2
3. spin, parity
4. hyperfragment
5. antiparticle
6. inv. particle
7. composite theory の formalism

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Q. N

mass (life-time) { $1/\tau < m/137$; lepton? }
charge q
spin, parity
I
C
n (family)

C は $\vec{I}$, q, n と anticommute

q, n, $\{C, \vec{I}\}$

Q. N. が互いに独立な場合. (practical)
dynamical (strong int.)

π^+ π^0 π^-
π^0: weak interaction
decay product
mass?

spin, parity

(1) $\pi^- + d \to n + n$ scalar ではない
(2) $\pi^+ + d \rightleftarrows p + p$ spin 0
(3) $\pi^0 \to 2\gamma$ spin 1 ではない
(4) $\pi^- + p \to n + \pi^0$ parity ($\pi^0 = \pi^-$)
(5) $p + p \to \pi^0$ 等で S ではない

$K^- + d \rightleftarrows p + \Sigma^-$

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